Digital Digest

Vol. 1 No. 1 *Devoted entirely to Digital Amateur Radio Communications* Nov/Dec 1988

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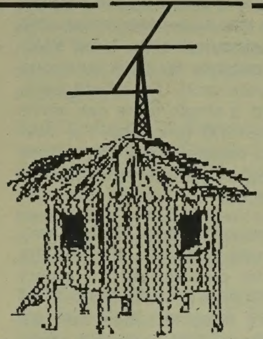


From The Publisher's Shack

We've finally made it! The first issue of Digital Digest is now off the drawing board and a reality at last. I won't belabor the blood, sweat and tears that have gone into the development and final production of D-D. May it suffice to say that it is great to see the first issue in print after reams of type galleys, paste-up boards and tissue overlays.

We've tried to allow for some flexibility in the actual publication date of this first issue to compensate for the unforeseen. For these reasons this issue is out later than originally intended. Future issues will be mailed on or about the 15th of every other month commencing with the January/February issue.

The interest in this publication has been overwhelmingly positive, both by you, the subscribers, and from the manufacturers of digital related products. We thank all of you for your support and intend to work diligently to maintain and build on your confidence.

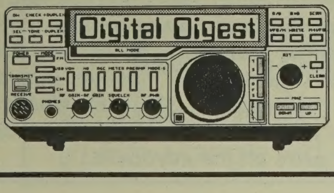
The purpose of this publication is to be an authoritative source of information on your favorite modes of digital communications. Within the pages of the Digest will be information on Packet, AMTOR, RTTY, Satellites, Computers, Software, etc. To be as valuable a source as possible to you, we encourage your input. Please write, call, or leave a message on CompuServe I.D.# 73330,1335. Let us know what information you would like to find, or see more of, or haven't been able to get. We'll listen, and we will do all we can to deliver.

Your comments, suggestions... and yes, even criticisms are all welcome. We are all involved in communications, and the better we communicate, all the better this publication will become. We've taken what we believe to be a first step in the right direction by gaining the literary support from some of amateur radio's most prolific hams and digital experts including: Norman Sternberg, W2JUP; Lynn Taylor, WB6UUT; Jonathan Mayo, KR3T; Lacy McCall, AC4X; Paul Newland, AD7I; Dr. Gary Garriott; Craig Rader, N4PLK; Gwyn Reedy, W1BEL; Andy Funk, KB7UV; Don Deem, KB4LLO, among others, all of whom will be sharing their knowledge in this and/or future issues of the Digest.

With our first issue, we felt it might be fitting to start with somewhat of a primer on some of the more popular modes of digital communications. Future issues will explore more advanced topics on an operational and technical plane. Our ultimate goal is for Digital Digest to be considered "the source" for obtaining current authoritative information within the growing spectrum of amateur digital communications.

My qualifications for publishing Digital Digest stems from a successful commercial communications career (in both print and broadcasting) over the past 20 years. I have also enjoyed being a ham for the past 27 years and believe that the advancements we have seen thus far in computer and communications technologies are but a glimpse at the future. It is with the idea, enthusiasm and inherent amateur inquisitiveness, no different than when we first tapped out our first "CQ's" from our spark gap transmitters (the first digital mode) that we are embarking on still new and wondrous means of digital communications. With the continuation of this spirit, with an eye and ear on the future, we hope to keep Digital Digest at the foreground as the exciting evolution in amateur digital communications continues to unfold.

73, and hope to see you on the air soon...
digitally speaking of course!



Please submit
letters, articles, club newsletters and other editorial material to my attention at:

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Tom

Tom Arvo, WA8DXD
Publisher

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The DIGIPEATER

News & Information communicated from various sources.

Microcomputers of the Future . . .

"Clone makers," lower price personal computer manufacturers whose PCs operate according to IBM specifications, are banded together to battle *Big Blue.* About 18 months ago, IBM brought out their Micro Channel bus - a patented device for transferring computer data to other periferals. Their thinking was since other firms couldn't legally copy the Micro Channel Architecture (MCA) design, they would quickly fall by the wayside unless they were licensed (and controlled) by IBM. Two things have happened, however that has IBM completely rethinking their strategy!

First, Micro Channel equipped microcomputers aren't selling. The public has big investments in hardware that won't work with the new bus . . . and second, a group of personal computer manufacturers, IC chip makers and software firms (who together account for more PC sales than IBM) have joined forces and have developed their own standards that not only work with the older 16-bit AT-bus but with the newer 32-bit IBM MCA-bus as well. In othe words, the clones have something that IBM doesn't offer... a better mousetrap so to speak.

The firms that make up the consortium are very well known indeed... Zenith, Tandy, Dell, Kaypro Corp, NEC, Hewlitt-Packard, Epson, Intel, Digital Equipment, Microsoft, WordPerfect, ... to name a few. The new bridge between the AT and MC bus is being called EISA... for Extended Industry Standard Architecture... although one firm is already calling it the ET-bus, coined from "ET Call Home" fame.

IBM apparently is very concerned about EISA... enough so that their newly improved PS/2 Model 30 doesn't have the Micro Channel architecture... instead the older 16-bit AT-bus. Industry analysts say that it is a good bet that IBM will be cloning the cloners before too long. One analyst said IBM had "made a blunder of PC-Jr. proportions." The IBM PC-Jr. is to microcomputing what the Edsel was to the automobile industry. The marketing cat-and-mouse game continues.

-Source: W5YI Report-

New TexNet Software Release

The Texas Packet Radio Society (TPRS) announced a new release (Version 1.2) of the TexNet software which includes new commands and functions. "CQ @ nodename" allows users to ragchew with unknown users via the network. Multiple Packet Message Servers (PMS) and Weather Information Servers (WXI) units can be installed and routed to via the network. "M @ nodename" routes the user automatically to that node's PMS. If the node does not have a PMS or WXI unit installed, an information message is returned to the user. "W @ nodename" connects the user to the weather information server at the name node.

A default PMS and WXI is also allowed at each node so that a user need enter only one letter to get routed to the "local" PMS or WXI. The defaults for both functions can be separate units. One hard drive sub-system at a single node can serve both PMS and WXI functions. For WXI messages, the node with the WXI system must be programmed for the desired weather products.

The TexNet source code is TEXNET.arc. The object code is Main12.HEX and the information for customizing the object code and EPROM is MAIN12.DOC. All of the code and documentation may be downloaded from CompuServe's HamNet. Questions should be addressed to Bill Wade, WD5HJP, or to TPRS at P.O. Box 831566, Richardson, TX 75083-1566.

Submitted by Bill Wade, WD5HJP via CompuServe's HamNet.

-Source: Gateway-

PC Packet Radio Terminal

Packet Terminal Program is a packet-radio terminal program that runs on an IBM PC (or clone) in conjunction with the AEA PK-232, AEA PK-87 and Heath HK-232 TNC's (all modes of the PK232 are supported except for FAX and NAVTEX). The program uses the TNC's "host-mode" to provide onscreen status information and separates incoming data, including monitored data, into separate "virtual terminal screens" that are displayed on demand. The program also automatically merges lines which were split in two when the transmitting station failed to enter a carriage return and automatically word wraps. Lynn Taylor, WB6UUT wrote the program, and you can obtain a registered copy by contacting him directly.

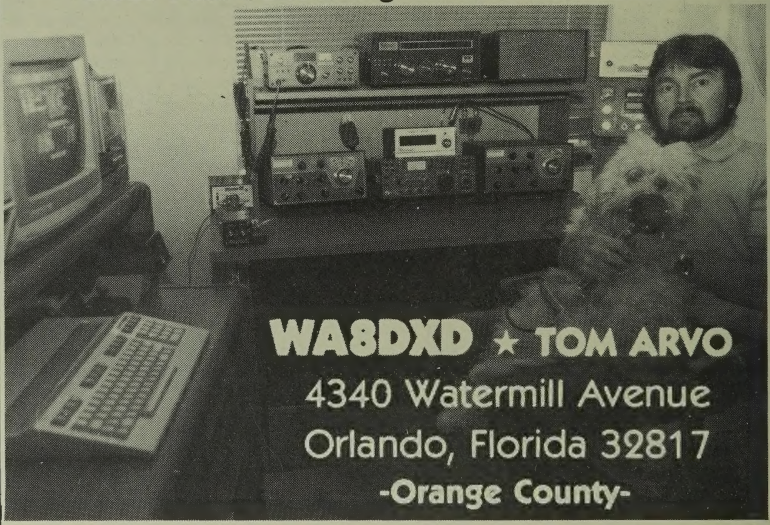
(For Lynn Taylor's address, see article on page 4) -Editor-

*** Please Note ***

If you have news and information of interest to the digital amateur community . . . please let us know!

-Editor-

Meet Your Fellow Digital Communicators



Tom Arvo, WA8DXD just recently joined the ranks of Packet after operating RTTY, and more recently Amtor. Tom has been a ham 27 years, first licensed in Michigan and moving to Orlando 6 years ago. Tom says when he is not on the ham bands, it is probably because he is at work running his advertising firm and overseeing the publication of Digital Digest. Other hobbies include sailing, travel and photography... note the "home-brew" QSL card. *What's a microphone doing in the hands of a digital operator??? Tom's assistant op, Winston (better known as DX-DOG), is all paws on the keyboard.*

SATELLITE TRACKING PROGRAM

Amateur Radio operators use the C-64 or C-128 for communicating via transponder and BBS-like systems that are on board various Amateur Radio communications satellites. Other C64/128 users like to receive TV and weather satellite signals. In each of these cases, knowing when the satellite is accessible and where to aim the antennas is essential to successful communication.

During satellite transits, SATCOM-64 provides key data at user-selected intervals of one minute or more. The user can select screenonly reports for quick searches, or a comprehensive printed report so that the microcomputer is available for communications use during actual passes.

SATCOMM-64 provides several useful features for the C-64 owner: it has a master menu to allow quick activity selection (12 operations); it can store information for up to 15 different satellites; it can quickly confirm W1AW Reference Orbits; a single entry of the time bracket during which you are available will allow a printed report for up to 31 days of access times (during the specified time bracket) for any satellite; a similar one time entry can also produce a report for any given day of the access times for up to three different satellites of interest.

Added features include easily changed satellite menu (together with associated frequency and Keplerian element data); choice of screen plus printed report, or screen alone; easily altered user defaults (start time, time increment, etc.); and ability to override defaults by simply making an entry.

SATCOMM-64 incorporates automatic switch-over from Standard to Daylight time and vice versa (this feature may be bypassed by international users). It also handles the annual rollover period during which the previous year's Keplerian elements have not yet been updated.

SATCOMM-64's printed reports include the following (for each user-specified time interval): relative azimuth and elevation, actual altitude, longitude and latitude, local time, UTC day, geographic areas that are within the satellite's communication range, doppler shift, minimum and maximum communication distance, operating frequencies, orbit number and phase.

As shipped, SATCOMM-64 is ready to print out detailed reports covering several amateur Radio satellites (OSCAR 9, 10, 11 and 12, RS-5, 7, 10/11) plus visible satellites (MIR, Kvant and Salyut-7) and weather/research satellites . . . (GOES/ WEFAX, NOAA, Meteor). Whenever desired, the SATCOMM-64 user may replace any of these with new satellite choices.

In summary, SATCOMM-64 overcomes many of the traditional shortcomings of satellite programs with features like annual rollover, Standard-to-Daylight time changeover, and single setup multi-day/multi-satellite reports.

SATCOMM-64 is compatible with the C64/128, 1541 drive and 1525 emulating printer, and is available at $15.95 (Missouri residents add tax) plus $3.00 P&H from:
Strategic Marketing Resources, Inc.
P.O. Box 2183, Ellisville, MO 63011.
Phone: (314) 256-7814 ■

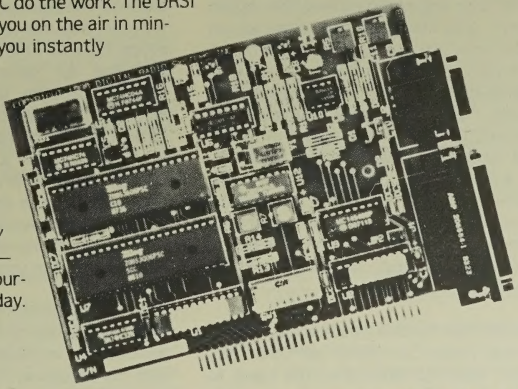
-Source: Worldradio-

If you received this issue as a complimentary copy, please see inside, back cover to start your subscription!

Easiest Packet Radio Ever!

▲ ▲ ▲ ▲ ▲

Is F E A R keeping you from joining the thousands of hams who are having the time of their lives with packet? FEAR no more! Here's the easiest packet radio set up yet — and you don't even need to buy one of those TNCs — just let your PC do the work. The DRSI PC*Packet Adapter plugs into your IBM PC (or clone) and gets you on the air in minutes. Seconds even. The one-page Quick-Start-Guide will have you instantly going like an expert. It doesn't even keep you from using your PC for other work! Now, in addition to everything else, you'll have a dual-port TNC with cross-band digipeating...even if you don't even know what that means right now. Find out why thousands of hams are so excited — get your feet wet in packet with the DRSI system. It's only $139.95.



To get going on the HF bands you'll want the DRSI HF* Modem/ Tuning Indicator — an extra $79.95. Go first class and get both — or stick to VHF with the basic PC*Packet Adapter. Find out for yourself why packet is the fastest growing phase of amateur radio today. It's a ball! See it at your dealer today.

▲ ▲ ▲

Packet Radio
without a
Packet Radio TNC

DRSI

Digital Radio Systems, Inc.
2065 Range Rd. ▲ Clearwater, FL 34625 ▲ (800) 999-0204 (813) 461-0204

Digital Digest -PACKET

by **Lynn W. Taylor, WB6UUT**

463 Myrtle Street • Laguna Beach, CA 92651

Packet Primer: The Basics of Connecting!

Have all your friend's been bitten by the Packet Radio Bug? Dialed across 145.01 MHz and wondered what all that braap-brap noise is? Find the idea of sending messages anywhere on VHF appealing? Jump on in!

To get on packet, you'll need three things: a radio, a computer or terminal, and a Terminal Node Controller.

The radio is easy. Most hams already have a radio that is suitable for packet. Your average 2 meter or 220 FM or multi-mode transceiver is fine, as are most HF radios. Even a handheld is OK to get started. The radio you eventually choose for packet operation should have a good receiver, be capable of switching quickly from transmit to receive (diode switching is preferable to relay switching, but not essential) and should power-up on the correct frequency. If you decide to run 24 hour packet operation (many stations do), a short power failure can accidently cause you to QSY if you are using an older radio that goes to a "default" frequency when power is applied. The computer or terminal is also not difficult. I'm sure most who read this publication will already have a computer, and if you already have the radio as well, you are two thirds of the way there.

Practically any computer is suitable. Many packet operators are using surplus Xerox 820's, Commodore 64's and 128s', IBM PC's or PC compatibles. The Apple // family and Macintosh are fine, as are the Commodore Amiga. If you don't have a computer, surplus computer terminals are available at most swap meets, flea markets, and the local purveyor of electronic junque. Make sure the terminal is capable of asynchronous operation, and uses the ASCII character set. Software for your computer is no problem - if you have a modem, just use whatever you are using with it. Later you can get specialized software which is tailored for packet.

Probably the hardest part today is the Terminal Node Controller (or TNC). No, it's not hard to find one, it's hard to choose one. Many manufacturers offer TNCs based on the TAPR TNC-2, which is the de-facto standard. These units differ widely in size and in power consumption, but all can run standard TAPR firmware and firmware from third parties. Most use the EXAR 2206 and 2211 modem chips, but some substitute the AMD 7910, other chips or their own design. Crystal controlled modems like the AMD chip are nice because they don't require adjustment, while the EXAR chips require periodic alignment. Most TNCs have a "calibrate" function built in. When shopping for a TNC, give some thought to the multi-mode units, these can offer RTTY (Baudot and ASCII), AMTOR, FAX, Morse, NAVTEX and SSTV all in the same package. Most multi-mode units are better for HF packet because of their more flexible modulator/demodulator sections.

A number of in-the-computer TNCs have become available lately, but I'm not too excited about them: if you want to run packet 24 hours a day, you have to leave your computer on 24 hours a day. Most stand-alone units can run without computer assistance. Once you have all the pieces, it's time to wire them up and get on the air. First, build the cable between the radio and the TNC. Most manufacturers have all the necessary cable building info in their manuals, but if your radio isn't listed that is not a big problem. Just connect the RX audio on the TNC to the speaker on the radio, TX audio to the Microphone audio, PTT to PTT, and ground to ground. Shielded wire is a good idea, and the TNC manufacturer will usually supply it. They usually won't supply the connectors for the radio, so make sure you have them when you get the TNC.

Next, you'll need an RS-232 cable from the computer to the TNC. If you have an external modem, just "borrow" that cable for now, buy one just like it, or get out the soldering iron and make one. Most TNCs will use the same cable as a Hayes external modem, or the TNC manufacturer can guide you to the right cable. Most TNCs also need a source of 12v DC. If your TNC has a "cube" transformer, just use that, otherwise you can grab the necessary power from any handy power supply. Turn everything on, start your terminal program and you are on the air (probably). Are you finished? Not quite.

The first stumbling block is baud rate. You need to match the baud rate, number of data bits, and parity between the TNC and the computer. Most TNCs can match their baud rate to the computer when the user types a few asterisks (*). Many TNC-2 designs require setting DIP switches on the TNC itself. To start, set your computer to match the DIP switch settings. If all else fails, 1200 baud, 7 data bits and even parity is probably a good guess. Of course, if you are getting the signon message and cmd: prompt from the TNC, and get responses from the TNC, you got past this one with flying colors.

The next stumbling block is audio levels. Set your TNC to monitor mode (usually by setting MONITOR ON, or MONITOR 6), and adjust the volume control on your radio until you start seeing packets on your screen. Set the volume so you see packets whenever a signal is received. Transmit levels are set similarly. Pick a station from the monitor display (most TNCs put an asterisk next to the stations you are actually hearing direct, and pick one which appears fairly often), then try to connect to yourself through that station (on most TNCs, I'd type C WB6UUT V N6RGZ if N6RGZ appeared frequently). If you don't find yourself connected immediately, try adjusting the AFSK level in the TNC. If you never get connected, pick another station. If you get connected right away, try adjusting the AFSK level anyway, and send yourself a line or two of text. These messages to yourself will go through faster if the level is right. That done, you are on the air.

Hopefully, this quick outline is enough to whet your appetite, and it really is this easy. Your TNC manual will help explain alot of the topics I simply didn't have room to cover, and we'll be talking about some more technical issues in the coming months. ■

Lynn Taylor, WB6UUT, has been active on the ham bands since being licensed in January, 1977. Lynn started in the digital modes early in his ham career (his 2nd QSO was on RTTY with a little help from his "Elmer" WA6LEW).

On the technical side of his digital exploration, Lynn designed and implemented "from scratch" an RTTY Mailbox; TAPR BETA Tester (one of the first 180 stations running AX.25) in February, 1982 which has been operating continuously since then. Lynn also wrote one of the first (if not the first) Packet Radio BBS systems, on the air in mid 1982, running on an Apple //e. The software is still operating at N6BGW-9.

Currently, Lynn is writing a multi-connect/multi-mode terminal program for the PK-87, PK-88, and PK-232. While employed with Rockwell, *as a hobby,* Lynn worked on hardware design of various mainframe computers for Burroughs Corporation and for NASA for the space shuttle program.

Lynn is presently at work on a variety of projects for a major manufacturer of optical mark recognition equipment.

It is with great pleasure and enthusiasm we welcome Lynn to the writing staff of D-D and look forward to his future contributions from which we can all benefit.
-Editor-

PACKET

by **Norman Sternberg, W2JUP**
279 Adirondack Drive • Farmingville, NY 11738

HF PACKET... or Excedrin Headache Number 5

I'm sure that by now many of you have heard that "packet doesn't work on HF". For those of you who've been trying your hand at packet on 20, 15 or 10 meters, or those who are thinking about it, here are some tips on what to do and how best to do it.

Regardless of what you may hear around town, packet DOES work on HF. But it WON'T work *unless* you've taken some special precautions. You've got to pay *extra attention* to two factors that you tend to take for granted in routine VHF/UHF packet operating:

- TNC Timing parameter values
- HF transceiver control

You really must hand tailor your HF transceiver tuning and also 'fine-tune' some of your TNC's parameter values.

W2HPM and I have been active on the HF SKIPNET services for about two years. We've successfully handled literally thousands of messages while operating under FCC Special Temporary Authorization (STA) for unattended operation. Such operation imposes the most severe burdens because SKIPNET is a network service - there are dozens of stations involved.

1. TNC PARAMETER VALUES

RULE 1: DON'T USE THE FACTORY
DEFAULTS IN YOUR TNC

The values stored in your TNC's EPROMS are totally unsuitable for HF packet operation; they are tailored for the average VHF case. Here is a set of recommended "non-default" parameter values for general purpose HF operation on 40, 20 and 15 meter packet operation.

MAXFRAME 1 to 2
PACLEN 32, 64 or 80
TXDELAY 40 or 50
FRACK 6

MAXFRAME

Choose a lower setting for poor conditions, a higher value for better conditions. We have very strong mathematical and experimental evidence (papers by Phil Karn and others) that MAXFRAME 1 provides better longterm throughput even on VHF!

If you send FOUR frames in one packet and the distant station ACKs only frame #1, then you're going to resend frames #2, #3, and #4. If he ACKs frames #2, #3 and #4 but bombs #1, you're going to resend all four of them again anyway. What's the point in cluttering the channel with two, three or four un-ACK'ed frames when the first one hasn't been accepted?

Each frame imposes a fixed "overhead" on the packet. This "overhead" is the Synchronization, timing, clocking, control and address information stuff that you DON'T type; the stuff that makes the protocol work. The simplest frame you can send has at least 19 bytes (152 bits) of overhead. Each BIT of each BYTE is tested by the error correction process.

Unless you have a definite need to maintain a specific document format, don't waste bandwidth inserting blank lines because you think it may "look good" on the other station's screen. If you're operating in the CONVERSE mode as most people tend to do, your packet frame is actually sent by the CARRIAGE RETURN or ENTER key.

That single CR/LF you type to make a blank line creates a frame that has exactly the same overhead as a frame that has 80 typed characters. This "overhead" is the packet protocol stuff like the sync, callsigns and control information - stuff that you don't see, that conveys no "user" information. Every blank line must be ACK'ed just the same as the fully typed lines. (It hurts to see a link time out retrying a blank line.)

PACLEN

Choose a lower setting for poor conditions, a higher value for better conditions.

This is the number of typed characters that makes ONE frame. The lower the number of characters or bytes in the frame, the higher the mathematical probabilities of getting through without taking a hit.

Each byte in the overhead mentioned above has eight bits. Each of the characters you type has eight bits. If any one of those bits in any one of those overhead bytes (or in your typed characters) takes a noise hit, then the error correction process fails, and the whole frame is thrown away.

Let's say that W2JUP is directly connected to W2HPM and sends the simple line:

Hello, Joe, how are you?>>

That small packet frame actually consists of at least 20 bytes (160 bits) of overhead, plus 27 bytes (208 bits) of your typed data, a total of 376 bits. If *any one* of those 376 individual bits is trashed at any point in the link during transmission, then the entire frame is thrown away by the receiving station.

Now let's assume that you're still using the factory-default value of PACLEN, 128 bytes, and that you're NOT typing any CR/LF so that your TNC is automatically sending the packet at your 129th typed character. Your frame might look like this:

Joe, I wanted to let you know that I wouldn't be able to go to the club meeting tomorrow night and you'll have to get a ride from . . .

The same simple arithmetic tells us that you've just sent 20 bytes of overhead, plus 128 bytes of the characters you've typed, resulting in a frame that has 20 + 128 * 8 ' 1184 bits.

Simple common sense says that the chances of getting 1184 bits through the link "unharmed" - are much lower than getting only 376 bits through without damage by the typical noisy HF radio environment. Now - if you happen to be operating with the factory-default settings (as your TNC is shipped from the factory):

MAXFRAME 4
FRACK 3
PACLEN 128

Let's look at MAXFRAME first. Arithmetic tells us that you've just sent a packet of FOUR frames, each one containing 1184 bits, totalling 4736 bits. The chance of ALL 4736 bits surviving the journey in typical HF conditions is a wee bit small.

We're limited by Part 96 to a maximum 300 bit-per-second data rate on HF packet. At 300 bits per second, each BIT of each BYTE (or character) has a duration of 3.3 *milliseconds.* You can see that it doesn't take much of a noise pulse to smear one of those many bits and thereby kill an entire frame. Have you ever measured the length of a single pulse from either the "Woodpecker" or your local power line noise?

Now, let's look at FRACK. The FRACK timer sets the amount of time that your TNC will wait for an ACK after the instant your PTT keys your rig. Contrary to a common misunderstanding, FRACK time is NOT counted from the end of your burst; it's counted from the *beginning.*

Let's assume you're still using the factory supplied default values

FRACK 3 (3 seconds)
TXDELAY 30 (300 milliseconds).

Let's say that you send our sample short line shown above:

Hello, Joe, how are you?>>

That packet frame contains 376 bits of stuff. More arithmetic:

- 376 bits @ 300 bits per second = 1.25 seconds
- 300 milliseconds TXDELAY = 0.30 seconds
- Length of burst = 1.57 seconds
- minus FRACK delay = 3.00 seconds
- Available response window for ACK = 1.47 seconds

(cont'd pg. 6)

HF PACKET . . .

(cont'd)

This appears to be logically possible - but is it really? Is this enough time for the other station to send you the ACK you need?

The other station's TNC must send an ACK whose minimum length will be 20 bytes or 376 bits. If he's using a slightly lengthened TXDELAY (say 400 milliseconds, a longish DWAIT of 320 milliseconds, a RESPTIME of 5 (500 milliseconds), or if his TNC hears anything on the channel and delays the ACK for even a few hundred milliseconds, we have an interesting problem.

Let's assume that the other station's TNC received a valid frame from your system, the channel is clear, and his TNC is going to send the ACK back to you. Now we've got a very cute "CATCH22" situation:

- 376 bits @ 300 bits per second = 1.25 seconds
- Distant station's TXDELAY = 0.40 seconds
- Distant station's DWAIT = 0.32 seconds
- Distant station's RESPTIME = 0.50 seconds

TOTAL DELAY before other station's end-of-data = 2.47 seconds

Remember that *your* system won't know if *his* ACK is valid until *your* TNC has received and decoded his entire frame. The combined delays introduced at *his* end now approach your FRACK time. You can't decode and validate his ACK before your FRACK timer runs out. Your TNC RETRYs your frame because the other station's ACK didn't arrive on time. And all this relates to his sending an ACK frame of only 20 bytes.

Now that we've had a taste of timing concepts, let's see why HF packet doesn't work and what happens if you're still using the factorydefault values:

MAXFRAME 4
PACLEN 128
FRACK 3

Our arithmetic said that you would send a packet of four frames, each one containing 1184 bits, totalling 4736 bits.

- 4736 bits @ 300 bits per second = 15.79 seconds
- 300 milliseconds TXDELAY = 0.30 seconds
- Length of burst = 16.09 seconds
- FRACK delay = 3.00 seconds
- Available response window for ACK = minus 13.09 seconds

You *cannot* fit a 16-second burst into a 3-second FRACK window. Your FRACK timer expires *before* you've finished sending the packet! This is not going to work!

Now, let's use the same arithmetic to see how our suggested values fit in here.

MAXFRAME 1 (Only ONE unACK'ed frame allowed on the air)
PACLEN 64 ((64 * 8) + (20 * 8)) = 672 bits
FRACK 6 (6 seconds)

- 672 bits @ 300 bits per second = 2.24 seconds
- 300 milliseconds TXDELAY = 0.30 seconds
- Length of burst = 2.54 seconds
- FRACK delay = 6.00 seconds
- Available response window for ACK = 3.46 seconds

This *will* work. Your single frame packet burst of 20 bytes of overhead and 64 bytes of your typed data adds up to about 2.5 seconds. About 3.5 seconds remain available as the interval during which you must receive the ACK from the other guy before your TNC will retry the frame.

Below 28 MHz you're limited to 300 bits per second. On VHF you've been using 1200 bits per second. Everything on HF takes FOUR TIMES LONGER to send, and FOUR TIMES LONGER to receive.

TXDELAY

Don't assume that TXDELAY relates ONLY to your radio's switching times. It also relates to the switching and other timing factors in the other station's radio. In our real world of HF packet radio, TXDELAY relates to the radios at *both* ends of the link.

Nearly all phase-locked-loop Synthesized radios have some measureable "settling time". This delay is introduced by some PLL frequency setting systems when switching from transmit mode to receive mode and viceversa. We also note that many HF transceivers have a significant delay even with "fast" AGC. This addititional delay occurs while the receiver's AGC circuit is "relaxing" and returning the receiver to full sensitivity.

One more cause of delays appears when the sending station uses AFSK in the single-sideband mode. Some operators are not careful to avoid driving the transmitter into ALC action. ALC (Automatic Level Control) tends to reduce the transmitter's power output at key-up time and, if excessive, can actually destroy the first few bytes of the transmitted packet frame. Those first bytes of each packet frame are the FLAG field, the information that marks the beginning of the frame and provides timing or synchronization information to the other station's TNC. If the flag is smeared during transmission, the receiving TNC can't use that frame and throws away whatever it receives after it. In addition, the more sync you have on the front of each frame, the higher the probability that the other station's TNC will successfully decode your frame in conditions of noise and propagation effects.

Extra flag also seems to help combat the effects of multipath and selective fades. Don't fall for that "Too much TXD cuts down my throughput" nonsense. If the other station doesn't decode your flag correctly, then all the bytes after the sync are trashed; the frame is thrown away. So much for your "throughput".

2. FREQUENCY CONTROL AND STABILITY

RULE 2: HF PACKET DEMANDS PRECISE OPERATING FREQUENCY CONTROL!

You've operated VHF packet without problems, so you've probably ignored your TNC's transmitted tones and calibration. You've probably devoted the same benevolent neglect towards your TNC's demodulator calibration. You connect to your buddies and to the local BBS; your rule has been "if it ain't broke, don't fix it".

On FM, the tones you receive are directly generated and controlled in the other station's TNC and vice-versa. Your TNC's tones are transmitted directly, unaltered, by your FM transmitter and received unaltered by the other station's receiver. Your synthesized radio's LED frequency display tells you you're on the same frequency as the other station.

But HF packet is a different story. The tones produced by your TNC may no longer be the same tones that come out of the other station's radio. The frequency of the tones recovered from the other station's receiver depend on how the other station's operator tunes his receiver. Whether you and the other station are using AFSK or direct FSK, the tones from the receiver will always be determined by receiver frequency tuning.

Tuning accuracy on HF packet radio is generally more critical than in the other operating modes. Tuning errors as small as 20 Hz can result in failure to decode packets successfully. The more selective the receiver and the TNC's filters, the more critical the tuning accuracy. Some IF filters can be too narrow to handle data at our usual HF packet rate of 300 bits per second. In general, IF filter bandwidths should be greater than 500 Hz for packet operation at 300 bits per second.

HF packet operation also imposes greater demands for overall transmitter and receiver stability. Unless the rig can hold frequency, plus or minus 20 or 30 Hz for more than just a few minutes, you may drift right out of a useable HF link and "die" from excessive retrys.

(cont'd pg. 16)

★★★ PACKET FOR PEANUTS ★★★

There's no computer that's in as many ham shacks as the Commodore 64. The availability of C64 software for all sorts of ham activities has made this budget priced computer a continued favorite, even though its speed may leave a lot to be desired. Commodore 64s make an ideal "dumb terminal" for use in packet radio, but some West Germans took it a step further. They came up with a program that turn them into "smart" TNC's. This disc-resident software, called DIGICOM>64, actually converts the computer into a full-featured Terminal Node Controller and includes user friendly terminal routines. The whole package, written in high-speed machine language, has more features than any commercial TNC/terminal program package available on the market. The best part about it, though, is its price...FREE!

DIGICOM>64 has all the traditional TNC2 commands and parameters plus a great deal more that makes the packet mode easier to use. Some of these features include:

1. Individualized connect messages for each station connecting.
2. Automatic Message writing to disc
3. Automatic QSO logging
4. Remote operation by selected stations
5. "Chat Mode" which allows several connected stations to talk to each other
6. File writing while connected
7. Program file transfer without conversion
8. Separate screens for each "stream"
9. Node operation
10. Customized "macro" commands

The only hardware interface required between the computer and the transceiver for Digicom is a modem. Barry Kutner, W2UP published his schematic for a switchable VHF/HF modem in the August, 1988 issue of "73" Magazine. The program works as well on HF as it does on VHF, but Barry's modem does not include any filtering or a tuning indicator. Those of you familiar with packet interfaces like the PK232 know that a good tuning indicator and very sophisticated filtering are almost a necessity on the low bands. The problem is that the received audio signal must be within 50 Hz of the modem's pre-set decoding frequency for it to be decoded. HF packet stations also tend to clump together very closely and "de-sense" each other. That's why simple modems alone are not very practical on HF. Of course, commercially-made HF modems, with very good filtering and tuning indicators, are available and are adaptable to Digicom. But they are expensive.

On VHF and UHF FM packet, (2 meters, 440, etc.), the problem with filtering and tuning becomes academic, because all the stations should be stable on the same frequency with a high degree of quieting. Modems for use with Digicom in these bands are extremely simple and inexpensive. In fact, they can be put together and tuned up with a minimum of effort and about $30.00 to $40.00. That being the only expense involved, Digicom is probably the least expensive way to break into the packet mode for those with Commodores. A new 1200 baud modem-card design has recently been introduced that plugs directly into the computer's cassette port and uses no external power supply. Its small size, (1-1/2" x 2 1/4"), and simplicity make it ideal for the packet newcomer to get involved.

The West German authors of Digicom continue to upgrade their work. Version 2.00, with all the features listed above, was released in November 1987 and is the one most in use at present. There is a Version 2.10 floating around Europe which we hope to get our hands on. Also in use is a dedicated Commodore C128 version whose speed is truly amazing. Complete, detailed documentation on Version 2.00 is available. Anyone interested in receiving a free copy, including the program, on disc can send me a blank disc, mailer and postage. Modem schematics and PC board etching patterns are also available free to hams who send me a self-addressed, stamped, business- size envelope.

Craig Rader, N4PLK
922 Baltimore Drive
Orlando, Florida 32810
(407) 629-2965

EZ Macintosh File Transfers via Packet Radio

It is easy to transfer Macintosh files of any type (text, graphics, etc) using a shareware program written by Raymond Lau. Mr. Lau created the application called StuffIt a few years ago to compact Macintosh files for transfer via telephone line modems as ASCII text files. The current version of StuffIt is Version 1.5.1 and it is available from CompuServe, Genie and other sources (a $20.00 shareware fee is requested).

To use StuffIt for packet-radio transfers, proceed as follows:

a. Use StuffIt to create a new archive file and select one or more files to be compacted into that archive. While this step is not required, it will significantly reduce the size of most files and allow a much quicker transfer. It allows multiple files to be transferred as a single unit.

b. Use StuffIt's BinHex option to convert this archive file (or any Macintosh file) into an ASCII-only format.

c. Transfer the BinHex ASCII file via normal packetradio methods to a PBBS or another Macintosh user. The receiving station may capture this text file easily because extra characters at the beginning and/or end of the file will be ignored by the BinHex routines, however, it is necessary to keep the rest of the file "clean", so, turn off the packet monitoring options and limit access from other users.

d. The receiving station uses the StuffIt to convert the BinHex ASCII file to a StuffIt archive.

e. Then, StuffIt is used to extract normal Macintosh file types from the resulting archive files. This method transfers Macintosh files with all the required information for icons, file names, etc.

StuffIt also includes the capability to encrypt files with a password. This may be in violation of FCC rules, so I do not advocate its use.

While I suggest that the best way to send computer files is with a disk, envelope and a stamp or two, the use of StuffIt does allow the transfer of large quantities of information, including graphics, using the speed and accuracy of packet radio.

Submitted by Rich Clemen, KB8AOB @ KA8ZXP *-Source: Gateway-*

Wishing all the merriest of holidays and a healthy and prosperous new year!

AMTOR

by **Paul Newland, AD7I**

Post Office Box 205 • Holmdel, NJ 07733-0205

— The APLink Connection —

Greetings! This column will cover, primarily, AMTOR but we will also look at other systems that are similar in function to AMTOR. To generalize, I'll be looking at low speed (less than 150 baud), single channel (as opposed to multiplexed) MF/HF radio data systems that provide error protection. Today I will be discussing the newest wrinkle for AMTOR during 1988: the APLink mailbox system. In future columns I hope to discuss many other AMTOR and AMTOR related topics. Some of those topics include the Coast Guard's new NAVTEX system on 518 kHz, selective calling systems based on AMTOR FEC, computer-to-computer communication using AMTOR, plus many others. If you have have other topics that you would like to suggest, please contact me directly and I will try to cover them in future issues. Now, let's talk about APLink.

APLINK

Many of you who operate RTTY are familiar with the concept of and RTTY BBSs (or MSOs) and those with Packet experience are familiar with Packet BBSs. Well, APLink does both -- it is a computerized mailbox system that normally operates with two ports. One port is connected to a HF transceiver via an AEA PK-232 (or AMT-1) while the other port is connected to a VHF/UHF tranceiver via a TAPR TNC-2 (or clone). The HF port speaks AMTOR while the VHF port speaks Packet. Both ports can be active at the same time. A message can be entered via AMTOR and then be relayed to other RLI or MBL compatible Packet BBSs. Voila!, an AMTOR/Packet interface. If you operate from a location that doesn't have a well known Packet BBS (and, yes, there still are many places around the world where that's the case), you can use the HF AMTOR port to send and receive messages to/from the North American packet network.

Here are a couple of examples to show the utility of APLink. Vic Poor, W5SMM, is APLink's developer. He lives on a sailboat that cruises the Gulf of Mexico and Caribbean for months at a time. Vic developed APLink after he found that HF Packet just couldn't provide the reliability that he wanted. He uses it to send messages to me via an APLink system in San Antonio. He sends his AMTOR message, via AMTOR, to the San Antonio APLink system. Once entered on that machine, the message is automatically sent to me in New Jersey via Packet. Message delay is only about 4 hours and that's all in the Packet network. I am another example of someone who greatly benefits from APLink. I leave messages on an APLink system in San Francisco which are then retreived by a friend in Honolulu. It's rare that we can have a direct connection between New Jersey and Honolulu, AMTOR or otherwise. But with APLink the communications is almost a snap.

AMTOR BBS operation is not going to displace Packet BBSs. However, for long range communications to places that don't have SKIPNET nodes nearby, AMTOR and APLink provide a nice solution. Vic is also working on semi-automatic message forwarding using AMTOR from one APLink system to another, as an alternative to HF Packet.

APLink provides many of the features of older RTTY BBS, but there are some differences -- differences that I really appreciate. Because APLink uses AMTOR the user gets good error control. Also, APLink makes maximum use of "answerbacks" for automatic login and message QSLing. APLink is primarily a mail messaging system that uses concise prompts and commands. Standard RTTY/CW abbreviations are used where ever possible so there isn't a lot of "verbiage" that you must wade through just to see if you have messages waiting for you. For someone who just wants service -- not a lot of extra print on the screen -- APLink is a welcome change.

There are several operational APLink systems around the U.S.A. Two that I often use are the WA8DRZ (selcal WDRZ) system in Redwood City (CA) and the KS5V (KKSV) system in San Antonio (TX). Both systems are expecting a mark tone of 14072.5 kHz (with space tone 170 Hz below that). WA8DRZ also scans X73.5, X74.5 and X74.5 so be sure to allow a little extra time when calling him. When connected, the APLink system will take control. You should do nothing until you get a prompt that askes for input. Your input should be the command

```
HELP <RET>
```

APLink does not expect you to enter a '? to turn the link around. This is done to avoid "race" conditions. APLink will always turn the link around, as needed, after you have given it a command. If it doesn't then APLink doesn't understand the command and you should enter it again.

If this is the first time you have logged onto this particular APLink system you will need to "register" as a new user. To do this give the command:

```
NEW "call" "selcal" <RET>
```

where "call" is your FCC assigned call sign (no /W1 stuff) and "selcal" is your four character AMTOR selcal (mine's AADI). Once you are logged in you can use the help file to see what's what. To logout you should give the command:

```
LOGOUT <RET>
```

and APLink will send you a sign-off message and drop the link. The system is really neat! Vic did a first class job with the software. Give it a try. I think you will be pleased.

For a limited time I can send you a free USER's (not SYSOP) manual if you send me a 9" x 12" S.A.S.E. with postage for 3 ounces of material. Send your requests directly to me at the address above and be sure to mark somewhere on your S.A.S.E. that you want the "APLink AMTOR User's Guide".

APLink SYSOPs Wanted

Code for APLink is free and available, again from me for a limited time, for an S.A.S.E. with a 5-1/4" MS/DOS formatted diskette. Since Vic lives on his boat he is away from home and unable to respond quickly to mail requests. So, I have taken on the job of distributing his software for him. I'm only a clerk in this operation and I can tell you very little about establishing a system. However, there are other people who I can put you in touch with who can help you get started.

(continued on page 18)

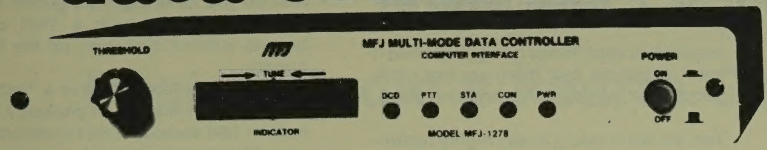
Paul Newland, AD7I, was first licensed in 1972. His amateur radio operation focuses on experimention with low speed data communications systems for use on MF/HF radio. Paul received a BSEL degree in 1979 from California Polytechnic State University and a MSEECE from the University of Michigan in 1980.

Currently, Paul is employed in an R & D organization where he designs radios for personal communications devices. He also supports the HF radio data communications needs of network operations groups within his company. Paul is licensed by the State of New Jersey as a Professional Engineer and is a Technical Advisor to the ARRL.

It is a great pleasure to welcome Paul to our staff of digital professionals who will be sharing their knowledge on a regular basis here in Digital Digest.

-Editor-

MFJ multi-mode data controller



9 modes for only . . . $249.95

Amateur radio's most versatile multi-mode data controller -- the MFJ-1278 -- lets you join the fun on Packet, AMTOR, RTTY, ASCII, CW, Weather FAX, SSTV, Navtex and gives you a full featured Contest Memory Keyer mode . . . you get 9 modes . . . for an affordable $249.95.

Plus you get MFJ's new **Easy Mail**tm so you and your ham buddies can leave messages for each other 24 hours a day.

You'll find it **the most user friendly of all multi-modes.** It's menu driven for ease of use **and** command driven for speed.

A high resolution 20 LED tuning indicator lets you *tune in signals **fast** in any mode.* All you have to do is to center a single LED and *you're precisely tuned in to within 10 Hz* -- and it shows you which way to tune!

Plus you get 32K RAM, KISS for TCP/IP, high performance HF/VHF/CW modems, software selectable dual radio ports, AC power supply and more.

All you need to join the fun is an MFJ-1278, your rig and any computer with a serial port and terminal program.

You can use the MFJ Starter Pack to get on the air instantly. It includes computer interfacing cable, terminal software and friendly instructions . . . everything you need to get on the air fast. Order MFJ-1282 (disk)/MFJ-1283 (tape) for the C-64/128 and VIC-20; MFJ-1287 for Macintosh; MFJ-1284 for the IBM or compatible, $19.95 each.

Packet

MFJ's new generation packet mode gives you genuine TAPR software and hardware plus many MFJ enhancments like Easy Mailtm.

A new Kiss interface makes the MFJ-1278 TCP/IP compatible.

Extensive tests published in **Packet Radio Magazine** ("HF Modem Performance Comparisons")prove the TAPR designed modem in the MFJ-1278 gives better copy with proper DCD operation under all tested conditions than the other modems tested.

New AMTOR mode!

Now the MFJ-1278 has a new AMTOR and Navtex mode, making it the only controller to feature **nine** digital modes.

MFJ-1278 transmits and receives AMTOR and includes all AMTOR modes: ARQ (Mode A), FEC and MODE S (Mode B).

Baudot RTTY

You can copy all shifts and all standard speeds including 170, 425 and 800 Hz shifts and speeds from 45 to 300 baud. *You can copy not only amateur RTTY but also press, weather and other exciting traffic.*

You can transmit both narrow and wide shifts. The wide shift is a standard 850 Hz shift with mark/space tones of 2125/2975 Hz. This lets you operate MARS and standard VHF FM RTTY.

ASCII

You can transmit and receive 7 bit ASCII using the same shifts and speeds as in the RTTY mode.

CW

You get a Super Morse Keyboard mode that lets you send and receive CW effortlessly, including all prosigns -- it's tailor-made for traffic handlers.

A huge type ahead buffer lets you send smooth CW even if you "hunt and peck".

You could store entire QSOs in the message memories, if you wanted to! You can link and repeat any messages for automatic CQs and beaconing. Memories also work in RTTY and ASCII modes.

***A** tone Modulated CW mode turns your VHF FM rig into a CW transceiver* for a new fun mode. It's perfect for transmitting code practice over VHF FM.

An AFSK CW mode lets you ID in CW.

You also get a random code generator that'll help you copy CW faster.

Weather FAX

You'll be fascinated as you watch WEFAX signals blossom into full fledged weather maps on your Epson or IBM graphics compatible printer.

Automatic sync and stop lets you set it and leave it for no hassle printing.

You can save FAX pictures and WEFAX maps to disk if your terminal program lets you save ASCII files to disk.

Pictures and maps can be saved to disk or *printed to screen in real time or from disk if you have an IBM or Macintosh* with the MFJ Starter Pack.

You can transmit FAX pictures right off disk and have fun exchanging and collecting them.

Slow Scan TV

The MFJ-1278 introduces you to the exciting world of slow scan TV.

You can print slow scan TV pictures on any IBM or Epson graphics compatible printer. If you have an IBM or Macintosh you can print to screen and save to disk with the MFJ Starter Pack.

You can transmit slow scan pictures right off disk. If your terminal program lets you save ASCII files you can save pictures from over-the-air QSOs.

You can transmit and receive 8.5, 12, 17, 24, and 36 second black and white format SSTV pictures using two levels.

Contest Memory Keyer

***Nothing** beats the quick response of a memory keyer during a heated contest.*

You'll score valuable contest points by completing QSOs so fast you'll leave your competition behind. And you can snag rare DX by slipping in so quickly you'll catch everyone by surprise.

Message memories let you store contest call, name, QTH, rig info -- everything you used to repeat over and over.

You get iambic operation, automatic incrementing serial numbering, weight control to penetrate QRM and more.

More Features

Turn on your MFJ-1278 and it sets itself to match your computer baud rate. Select your operating mode and the correct modem is automatically selected.

Plus . . . printing in all modes, threshold control for varying band conditions, tune-up command, lithium battery backup, RS-232 and TTL level serial ports, watch dog timer, FSK and AFSK outputs, output level control, speaker jack, key paddle jack, test and calibration software, Z-80 at 4.9 MHz, 32K EPROM, and socketed ICs. FCC approved. 9x1½x9½ in. 12 VDC or 110 VAC.

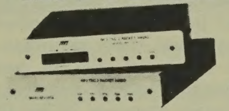
Get yours today and join the fun crowd!

New Firmware Update

A new KISS/AMTOR/Navtex Firmware update is available to MFJ-1278 owners.

MFJ's powerful update is the most reasonably priced mulit-mode upgrade by any manufacturer. Contact your dealer or MFJ for yours today!

MFJ Packet Radio



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You can double your fun by operating both VHF *and* HF packet because you get **high performance** switchable VHF/HF modems.

You get MFJ's new **Easy Mail**tm with soft-partitioned memory so you and your friends can leave messages for each other 24 hours a day.

In MFJ's new WeFAX mode you can print full fledged weather maps to screen or printer and save to disk using an IBM compatible or Macintosh computer with an MFJ Starter Pack.

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You also get 32K RAM, a full one-year unconditional guarantee and you can use 12 VDC or the included 110 VAC power supply.

For dependable HF packet tuning, the **MFJ-1274** gives you a high resolution tuning indicator that's accurate to within 10 Hz -- and it's only $20.00 more.

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Digital Digest

-BITS & BYTES

by **Lacy McCall, AC4X**

3001 Zelda Drive • Montgomery, AL 36106

Net-Rom / Protocol / and More!

It has been interesting to watch the Net-Rom movement take hold and the resulting change in Packet Radio. Many like myself, have watched with curious interest, as the battle has raged over whether or not N?R will in fact increase thru-put! What has been completely lost is that by creating a SuperNet (whether N?R is better or not), packet radio has become a bbs mode. Since so much "traffic" is passed, it is not much use dialing up a BBS. Just watch your screen, and you can easily copy all the mail and bulletins being passed. In fact, according to the N?R advocates, "thruput (what ever that is) is much better when individual stations don't gum up the frequency by transmitting".

Lets look at large metropolitan areas first. There are many packet stations, and presumably many bbs stations; each anxious to transmit. Any message passed the old fashion way (via digis) likely gets clobbered, or at the very least, takes many re-trys to make it thru. The answer is first, to do away with digis (which has always been a temporary fix),re-place them with N?R stations and then to get rid of all "local" traffic by having another LAN frequency. Then, really get organized. In fact, some nets are so well organized, you can only access them after being officially approved. WOW! All that sounds just like what every Ham wants.

Now, let's look at the boonies...like Alabama. Here, it's a good thing the bbs systems talk to each other, or they would be mighty lonely. There are not enough callers to even approach a usable bbs system. Then the result is that either the sysops get fired up about traffic handling (including bulletins and junk like this editorial), or they pull the plug and go back to HF chasing DX. *In short, we have lost sight of what promised to be a really new ham radio adventure.*

For a long time before getting into Packet at all, I listened and observed many others taking the plunge. Most times the water was not pleasant and after fooling with packet for a while, the second owner got a bargain on the slightly used TNC, which started the routine again. Like personal computers, TNC's occasionally found an owner that liked all the technical stuff, so the mode has grown. But (say again BUT), the individual packet operator has been very temporary, and the single operator after all is the Customer for all those BBS systems. Fortunately, the constant influx of new people has kept things going, but I find it hard to believe that there are not more people that can see what is taking place.

Yes, we are creating a very highly technical and sophisticated network system, but if anybody thinks that packet radio is the fastest way to deliver anything, he's crazy. In a real emergency, only the lowest priority traffic would be suitable for handling by packet. It is true, however, that what finally gets thru will likely be letter perfect. That is if we keep improving "thru-put".

One of the really fine aspects of Ham Radio is the experimental nature which allows advancements in not only modes of operation, but a constant upgrading of equipment and techniques. And I suppose that has been the main drawing card of packet radio. In a world where few really do build their equipment any longer, packet affords a new frontier; it appeals to the experimenter and the curious in us all. But unlike other parts of this hobby, we propose to limit operators with some well-meaning plan.

Now, let's face the facts:

- Packet radio bbs systems first serve the individual operator.
- Packet radio is a slow mode at best.
- Packet radio offers complete automation possibilities...(ie: a purely machine environment - if desired).
- Packet radio in an emergency situation, is likely to be effective only locally and for the lowest priority traffic.
- Packet radio is a very good way to share bulletins and messages.
- Packet radio will face dead silence (a blank screen) if individual operators cease to use it to talk to each other.

None of this is to say that N?R is a bad idea and that all those people that are working long hours to create a successful network system are wrong. They are not! And further, they are doing what ham radio is all about.

What I am seeing though is the technical frenzy that may reduce the whole of packet to an off-line mode, where few hams (not sysops) will care anything about participating. I am sure, there will be enthusiasts like RTTY and slow scan, but the wide acceptance (and revitalization of the hobby) that we have witnessed may well be slipping away. What are the alternatives to the current direction? I'm asking so that just maybe others will start to think about what is happening, not just cuss N?R; or for that matter, run out and buy N?R.

Here's some food for that thought:

- Why do you think digis are good? Because anybody with a TNC can be one without cluttering up the frequency.
- Why is it necessary to have a "letter-perfect" transmission of packets? It's not! If I had waited for 50 conditions, I would have never worked many country's.
- What's the fastest way to increase thru-put? RELAX PROTOCOL.

What I think, is that we should be looking for ways to get more people transmitting. And to use technology not to be more precise but to be more permissive. Then let the operator ask for a fill if necessary. We need more people transmitting across a couple of states, thru several digis and poking around a remote bbs. What we really need is more people that think Kiss is what you give your sweetie.

What we don't need is a bunch of bbs systems talking to each other, and that brings us to N?R. If I want to talk to another person 250 miles away, the most efficient technique in the world ever is the telephone. The same goes for 2500 miles and the same goes for people on other continents. If I want to send written correspondence, the international mail or telex systems are certainly the best. But if I want to enjoy the hobby of amateur radio, which are much slower and less efficient methods, I am drawn by the challenge of the uncertain nature of conditions. To try to emulate commercial systems is foolish, because once that happens, the challenge is gone.

One of the things that has often made amateur radio the only means of communication in emergencies, is that commercial systems fail because they are precise and so dependent of proper links. Here we go, departing from what has been our real attribute. I believe in the old saying "dance with the one that brung you", and this hobby has gained respect not because it is the most efficient, but because hams are innovative and can cope with less than desirable conditions.

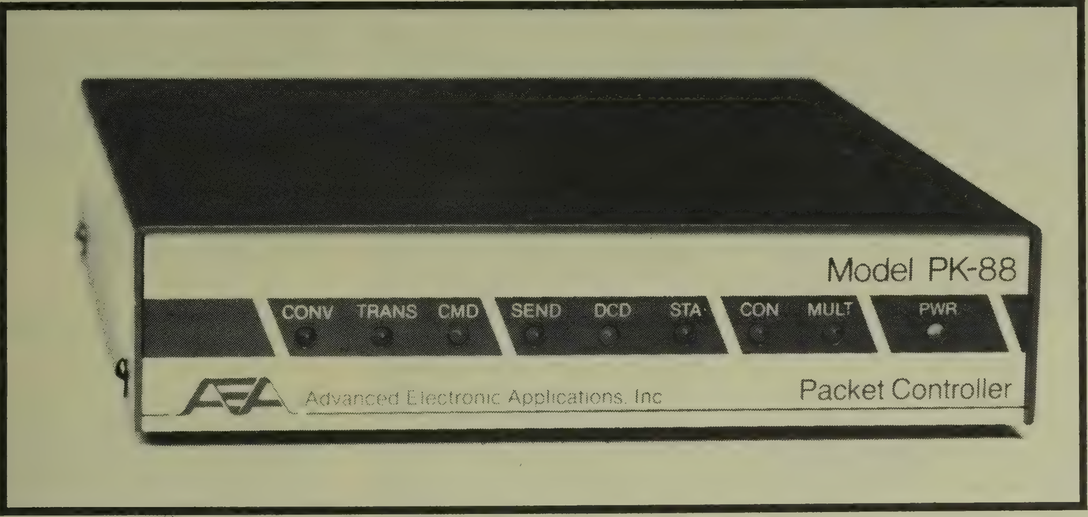
We need to focus on that as our goal for packet. I have no need to be able to call up a local N?R station and single-hop (or so it would appear) to my friend up the road a couple of hundred miles. In fact, it's kind of nice and a little exciting to pick my own path just to see if I can do it. And when we do connect, if I miss anything (that looks interesting), I can always ask for a fill. Think about it! //AC4X//

Don't miss Lacy's insights into various issues and items affecting digital communications in future articles. Welcome! -Editor-

New AEA PK-88

Packet Radio's Fourth Generation

AEA is proud of its contribution to the packet revolution in amateur radio. We were the first manufacturer to provide a commercial packet controller. Our newest controller, the PK- 88, is the fourth generation in a proud line.



Improved hardware and software design make the PK-88 your best choice for a packet only controller. Integrating the popular packet software from the multi-mode PK-232 with a special AEA TNC hardware design gives you the best of both worlds.

The new Maildrop feature of the PK-88 gives you the convenience of a personal mailbox. You can program 8K of memory in up to 15 different files with information that others can download. This information can be programmed for retrieval by a specific callsign, or made available to all connecting stations. Maildrop will also store incoming data sent to your station. The PK-88 is compatible with the popular TCP/IP protocol, and can be modified for NET ROM operation. The unique host mode of the PK-88 also gives programmers the ability to write special terminal programs (like AEA PC Pakratt and Com Pakratt programs) for full featured TNC use. Other software features of the PK-88 allow the operator to restrict the use of the station for both connects and as a digipeater. The mailbox monitoring command allows monitoring without displaying the callsign headers, while standard monitoring includes both MFROM and MTO lists.

For base station, portable or digipeater operation the PK-88 makes packet radio easy and affordable.

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Digital Digest

RTTY/CW

by **Jonathan L. Mayo, KR3T**
3908 Short Hill Drive • Allentown, PA 18104

RTTY TODAY: Something Old - Something New

A decade ago, when amateur radio operators mentioned digital communications, they were most probably referring to radioteletype (RTTY). Modes such as AMTOR, ASCII, and packet did not yet exist in amateur radio. Needless to say, things have certainly changed. Today digital communications encompasses a multitude of modes. I'll briefly review the major digital modes a little later, but let's first refresh ourselves about a mode that has received comparatively little press in recent years - RTTY.

Conveniently overlooking CW, it can be said that RTTY is the grandfather of all modern forms of digital communications. This article is an up-todate look at RTTY, describing current equipment and operating practices. As you will soon see, RTTY isn't what it used to be. RTTY has been modified, improved, and some even say replaced by other modes, but RTTY is still with us in its original form. Despite all the technological advances made in the past decade, it is not easy, or sometimes possible, to distinguish a RTTY signal generated by a modern multi-mode interface from an old-time Terminal Unit (TU) connected via a current loop to a mechanical teletype.

Although I had a RTTY station set up in my shack several years before I got involved with packet radio, I have not operated RTTY much at all over the past few years. Packet, with all of its technological sophistication and rapid growth, has garnered a lot of attention. More and more people, it seems, are rediscovering RTTY. RTTY is a comparatively simple mode ideally suited for the HF operating environment.

Modes of Digital Communication

The Morse code is one of the oldest forms of digital communications. The Morse code contains most characters needed for communications. With the advent of computerized units, Morse code can be automatically sent and copied. However, the slightest bit of interference or imperfect sending can reduce the decoder's ability to accurately copy the code.

Baudot RTTY (Radio TeleTYpe) uses a form of digital coding known as the Baudot (or Murray) code. In the Baudot code, each character is made up of five levels (commonly called the mark and space elements). However, there are only 32 possible combinations using a five level code. Therefore, the Baudot code includes two different character sets, figures and letters; the character sets are alternated as needed.

ASCII RTTY was first legalized in 1980 by the FCC for amateur use in the United States in response to the wide proliferation of computer equipment which uses the seven element ASCII code. ASCII's primary advantages over Baudot RTTY are its speed (ASCII is usually sent much faster than Baudot) and its 128 possible characters. In operation, ASCII RTTY is very similar to Baudot RTTY except for the coding used.

AMTOR (AMateur Teletype Over Radio) was first legalized for amateur use in 1983. AMTOR uses a special coding in which there is a constant radio of mark and space elements. If the received characters do not have the proper ratio, they are presumed erroneous. Because of this error checking, AMTOR is much more reliable than standard Baudot or ASCII RTTY.

Packet is the most advanced form of digital communications available to radio amateurs. The primary advantages of packet radio are speed, networking, error checking, and efficient use of frequency space. Packet radio operates using a standard digital communications networking technique known as Carrier-Sense Multiple Access with Collision Detection (CSMA/CD). Put simply, this means that a packet station will not transmit when the frequency is busy. It will wait until the frequency is clear and then transmit a short burst (frame) of information. Because packet transmissions are very short, many packet stations can be on the same frequency without interfering with each other. A line of text that takes 30 seconds to type can be transmitted in a fraction of a second.

RTTY Basics

Any RTTY station must have three basic components: a terminal, a Terminal Unit (TU), and a transceiver. The terminal converts characters into digital codes and vice versa. The Terminal Unit converts digital signals into analog tones and vice versa. And finally, the transceiver transmits and receives the analog tones.

When transmitting, characters typed on the keyboard of a terminal are converted into digital codes which are sent to the Terminal Unit. In the Terminal Unit, the digital codes are converted to analog signals which are sent to the transmitter. The transmitter then transmits the analog signals.

At the receiving end, the receiver receives the analog signals and sends them to the Terminal Unit where they are converted back into digital codes. The digital codes are then sent to the terminal where they are converted back into characters which are sent to a display, printer, or other device. Either way, digital codes, analog signals, and conversions are involved.

There are two standardized digital codes in use in RTTY: Baudot (Murray) and ASCII American Standard Code for Information Interchange. The Baudot code is the most common in terms of use. The Baudot code is a five level code and ASCII is a seven level code. Allow me to explain what that means.

In the binary system, there are only two states, represented by 0 and 1. The binary system is used extensively in digital communications. The two states can be represented by two different voltages, currents, or frequencies. In order to represent more than two different conditions using the binary system, bits must be combined to increase the number of possible conditions.

(continued on page 18)

Jonathan L. Mayo, has been involved with electronics, computers, and digital communications for many years. Jon is a licensed Extra class amateur radio operator, callsign KR3T, and has been writing professionally for several years in science and technology subject areas such as radio based digital communications, electronics technology, and general science. Jon has written numerous articles dealing with amateur radio; from equipment reviews to feature articles. He is one of the most prolific authors of amateur packet radio material. Some of his articles have been translated and published in foreign amateur radio magazines. Jon has also given many presentations and demonstrations for amateur radio clubs and other organizations on digital communications. His books include The Packet Radio Handbook and Superconductivity - The Threshold of a New Technology. The second edition of The Packet Radio Handbook, containing newly updated information, will be released in April 1989.

We enthusiastically welcome Jon to our staff of professional correspondents here in Digital Digest. Jon will be sharing his wealth of knowledge in the digital technologies in future issues. Stay tuned!
-Editor-

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by *Jonathan L. Mayo, KR3T*
3908 Short Hill Drive • Allentown, PA 18104

A Microcomputer In Your Shack?

Microcomputers have revolutionized the way we work and play, especially in amateur radio. While perhaps a bit exaggerated, these days personal computers (PCs) are almost as common in ham shacks around the world as are transceivers. A personal computer is a great asset to any digital communications operator. A PC can be used as a terminal for packet radio TNCs and other digital radio modems, to predict the orbits of OSCAR satellites, to simulate antenna designs, to design printed circuit boards, and a multitude of other tasks.

This article takes a look at what makes up microcomputers so that you will have a better understanding of what goes on inside them. By the end of this article, you should know enough about how computers operate that you can rapidly acclimate yourself to the various brands, whether IBM, Apple, Commodore, or some other. We'll start off with a look at what makes personal computers, along with other modern electronic items, possible - the integrated circuit.

Integrated Circuits

In order to fully understand microcomputer technology, digital communications in general, and packet radio in particular, it is helpful to have some understanding of integrated circuits and computer systems. Integrated circuits (ICs) have truly revolutionized electronics over the past two decades. Without ICs, it is safe to assume that most of the electronic devices we have today including TNCs) would not have been developed.

Integrated circuits are easy to recognize. They are usually small rectangular chips made from a black plastic material with metallic leads coming out the sides. But there is much more to an IC than this. Sealed in the plastic housing is a miniature square of silicon material measuring a few millimeters on each edge. Etched on this chip of silicon are the electronic circuits that determine the function of the IC.

Typical IC circuits consist of many transistors and gates. Memory chips often contain hundreds of thousands of transistors. There are six main gates: AND, OR, XOR, NAND, NOR, and Inverter. These gates are designed to carry out the rules of Boolean algebra which is based on the binary system. Each gate gives a different result depending on the combination of bits applied to them. (This won't go into detail on how each gate specifically operates or how different types of gate circuits are designed.)

The construction of integrated circuits is a processing marvel. Successive layers of resists, dopants, metals, and other materials are applied to a silicon wager to develop the desired circuits. When all the layers are finished, the wafer is broken into hundreds of chips and tiny wires are attached to the inputs and outputs of the chip. The chip is then sealed in plastic with the tiny input and output wires attached to the metal leads sticking out of the plastic.

ICs have been designed to handle almost any desired digital task from central processing units, to memory, to multiplexers and so on. Were you to open the case of any modern computer, you would see rows and rows of ICs covering the circuit board, each with a specific job to do. However, ICs do not work alone. They must have support components to define and regulate their operation. These support components consist of connecting circuits, resistors, capacitors, crystals, and so forth.

Microcomputer Systems

With the advance of the microcomputer revolution, more and more amateur radio operators have one or more micros performing a variety of functions in the ham shack. Whether or not you decide to use a microcomputer as a communications terminal in your digital communications, it is helpful to know a understand a little about microcomputer systems because they are in such wide use in digital communications.

Microcomputer systems are made up of two major components: hardware and software. Hardware is what most people visualize when they think of microcomputers. Some examples of hardware are physical devices such as CRTs (Cathode Ray Tubes), keyboards, disk drives, printers, modems, and their associated circuitry (see Fig. 1 and Fig. 2). Before going any further, let's take a look at what makes up a microcomputer.

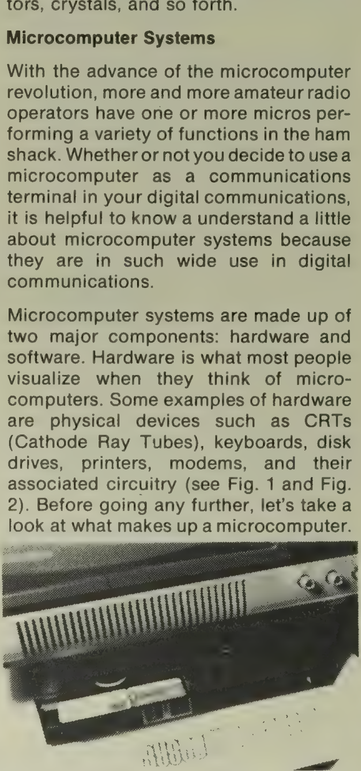

FIG.1: Two 5.25" disk drives.

A basic microcomputer is actually composed of only four different sections: input, CPU, memory, and output. Input can take the form of a keyboard, disk drive, or anything else which allows for the input (entry) of information into the computer. The central processing unit (CPU) is the brains of a computer. It manages the flow of information to and from the other components and performs arithmetic operations. (In computerese, the word arithmetic is pronounced so that it rhymes with "paramedic," not "ahrithma-tick" as it was in grade school.)

Memory is used for the storage of data and programs, It can be written to and read from (as with RAM, which stands for Random Access Memory); however, some forms of memory cannot be written to once initially programmed (like ROM, Read Only Memory).

Output is were the CPU directs any information to be sent to the user or for storage on an external device. Some examples of output are display monitors, disk drives, and printers.

You may have noticed that disk drives are listed as examples of both input and output. This is perfectly alright, as some devices are used for both storage and retrieval. These devices fall under the header of I/O for Input and Output. But all this hardware is useless for its intended function without software. An apt analogy would be a car full of gas and ready to do but without a driver.

Software tells the hardware what to do and how to do it. It is simply a list of instructions telling the computer how to accomplish a task. Software comes in many different forms and on various media. Media is the physical device on which the software instructions are stored. Some typical microcomputer storage devices include permanent memory (ROM), cassettes, and most commonly, floppy disks. Software stored on permanent memory chips is usually called firmware and can be found built into the computer and in plug-in cartridges. Most often rudimentary programs such as system monitors and basic operating systems are included in

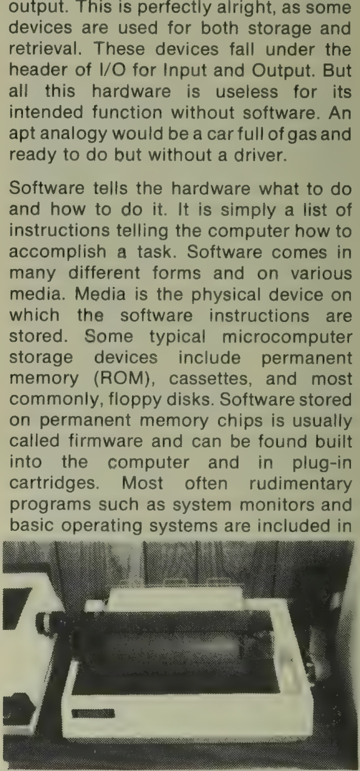

FIG. 2: An Epson MX-80 dot printer.

permanent memory on the computer's motherboard. The motherboard usually contains most of the basic circuitry of the computer.

An Operating System is an extensive program that tells the computer how to operate. It assigns memory locations for various functions, controls the external storage and retrieval of information, and the other control functions needed for the operation of the computer system. A Disk Operating System (DOS) is used to control access to the disk drives. Some examples of current microcomputer disk operating systems in use today are MS-DOS, TRSDOS, CP/M, UNIX, ProDOS, and OS-9.

In order to do anything productive with a computer, you must have applications software. Applications software is used to accomplish a specific task with a computer. For example, word processing. Typical applications programs used in amateur radio might include a terminal emulator, a CAD (Computer Aided Design) program, and a satellite tracking program.

Microcomputer Systems

Now that you know a little about how computers operate, let's take a look at some of the microcomputers in use in amateur radio today. IBM personal computers (and clones) and Macintoshes are the "big two" in the personal computers today. A relatively good IBM-PC clone that would serve as a fine shack computer can be purchased for under $1000. Macintoshes are rarely purchased for use soley in the shack, but many pull double duty as a family or business computer and in amateur radio applications.

More typical computer in the shack include the Commodore 64 (See Fig. 3), which costs around $100 without a monitor. Another popular computer is the Apple //, shown in Fig. 4. Radio Shack TRS-80s (See Fig. 5) are also very common. What computer you end up with will depend on your budget and needs.

Conclusion

Personal computers are rapidly evolving into an integral part of any modern amateur radio station. In digital communications, especially packet, they are almost indispensable. The purpose of this article was to introduce you to microcomputer technology and some common systems in use today. You will undoubtedly want to conduct more research before making any buying decisions. If you have any questions or comments, please write me. Alternately, you can leave me a message on CompuServe (I.D. #72276,2276).

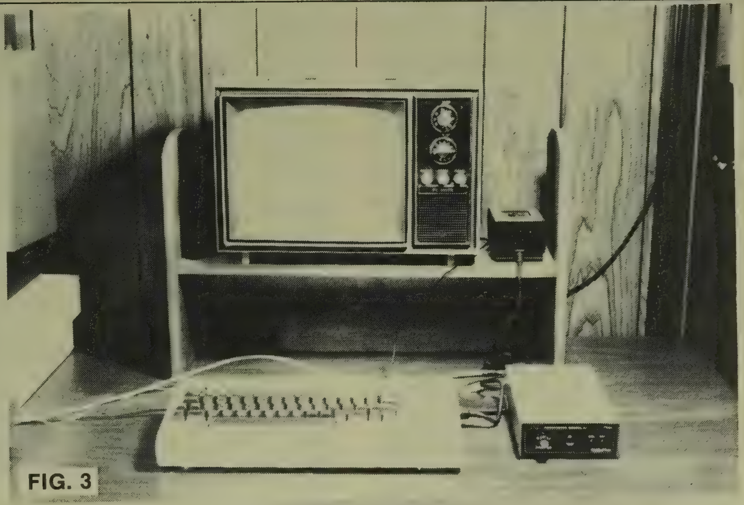

FIG. 3

FIG. 3:
A Commodore C-64 computer is interfaced to an AEA PK-64 multi-mode data controller.

FIG. 4

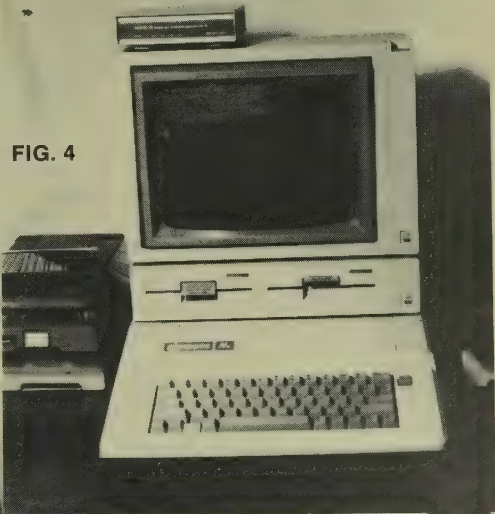

FIG. 4
An Apple //e computer running terminal emulator software interfaced with a Kantronics KPC-II TNC.

FIG. 5

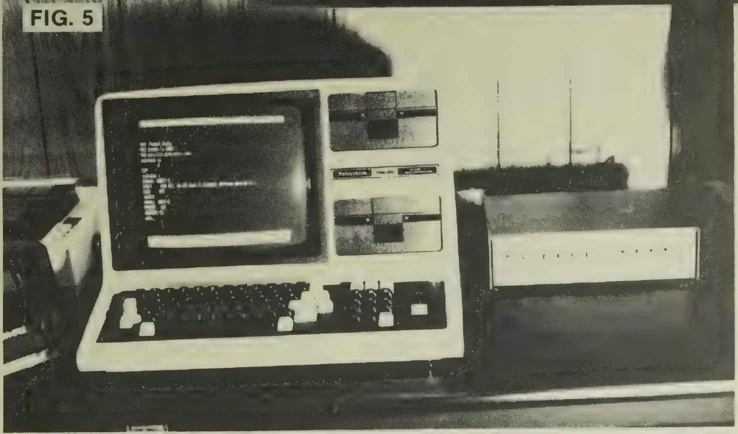

FIG. 5:
A TRS-80 Model 4 computer running terminal emulator software interfaced with an AEA PKT-1 TNC.

HF PACKET . . .

(cont'd)

There are other interesting problems. Unlike conventional Baudot, ASCII RTTY and AMTOR, packet signals use a data format called NRZI (non-return-to-zero-inverted), which in effect ignores data sense (mark-space polarity). On HF packet, you can use upper sideband or lower sideband equally well. The only difference will be in the frequency shown on your rig's tuning display. You can be on USB while your link partner can be on LSB. Your rigs will appear to be on different frequencies. In general, most stations using AFSK tend to operate on LSB. It's best to use the same sideband as the station you're working.

To set up a schedule, or connect to a PBBS, or link in a network system, you can't always go strictly by the frequency displayed by most modern HF rigs. There is no industry-wide standard as to the exact meaning of the numbers shown. Some transceivers display the frequency of the suppressed carrier in SSB; some show the frequency when your rig is tuned to Mark (lower) tone, some show tuning for Space (higher) tone. Some HF rigs even provide front-panel adjustment of the digital display to whatever the user wishes; carrier, USB, LSB, FSK either tone, etc.

For the AFSK packet operator, this situation is somewhat complicated by the lack of an industry-wide standard for HF Mark and Space tones. AEA's PK64 and PK-232 TNCs use 2110 Hz as Mark and 2310 Hz as Space, about in the same range as the traditional RTTY tones at 2125 and 2295 Hz (plus and minus 15 Hz).

Most licensed clones of the TAPR TNC-2 (including the AEA PK-80) use 1650 and 1850 Hz for Mark and Space respectively. TNCs using the AMD7910 "World Chip" modem (including AEA's PK-87 and PK-88) provide a choice of 1075 Mark and 1275 Space, or 2025 Mark and 2225 Space.

When using AFSK, your rig's displayed frequency will literally depend on the tones being transmitted by the distant station, and also on the frequencies to which your TNC's demodulator and filters are tuned. Check your TNC and transceiver operating manuals to determine what audio tones your TNC uses for Mark and Space, and how your rig's digital display relates to the received and transmitted frequencies.

There are some subtle problems in HF packet radio. You may see lots of interesting packet signals, send repeated connect requests - and nothing! You check your timing parameters; they're all what they should be. You set AGC to "FAST", you verify that "ALC" is not active. VOX is turned off, the rig is putting out power, the antenna is connected, everything appears "normal - and still nothing! What can be wrong here?

You've probably assumed that your rig is receiving *and transmitting* on the same frequency shown by your digital display. This is *not* always true! Some of the most-recent HF transceivers seem to have as much as 100 Hz difference between the receive and transmit frequencies. This is enough to guarantee your inability to establish and maintain a decent packet link. Don't assume anything! Be prepared to tweak your RIT/XIT controls to make the link work. You may require either a good counter or a patient partner to determine how your rig is behaving and if you're really sending and receiving on the same frequency.

3. CONCLUSIONS

You too can work HF packet successfully. Remember these general principles:

- Assume nothing
- Take nothing for granted
- Check everything twice
- Recognize that there are major operational differences between VHF and HF packet radio.

Remember the two most critical factors for success on HF packet are ***TIMING and TUNING***

Norman Sternberg, W2JUP has been an active ham for over 40 years. Over this period, Norm has achieved a respected reputation for his knowledge in the varied areas of amateur radio communications.

Norm is a widely published author, and an authority on amateur digital communications, both in the operational and the technical aspects of our hobby.

He is a retired systems engineer and is currently technical adviser to Advanced Electronic Applications, Inc.

We are ecstatic to have acquired Norm's penmanship. In this, as in future issues we will all benefit from his vast wealth of knowledge and experience. I also wish to give a special personal note of gratitude to Norm for all the expert advice and support he has shared so freely over the many months of planning and producing the Digest. So, here it is Norm, a big

T-H-A-N-K-S!

-Editor-

DX Software Review

Program	2nd OP, Version 1.0
Author	Jim Rafferty, N6RJ
System	IBM-PC or compatible
Price	$59.95 suggested retail

Most DXers are familiar with that venerable circular slide rule, with its host of valuable DX data, known as the 2nd Op. This handy device was developed by the late Larry Lekashman many years ago and no DXer's operating position was complete without one. My original one was the "W9IOP 2nd Op." That will tell you how many years I have been around DXing!

Essentially, N6RJ has "computerized" the original 2nd Op concept and has significantly enhanced its features and the information it makes available. The program is supplied on two 5¼" floppy diskettes (it is also available on a single 3.5" micro-floppy) and comes with a 19-page user's manual. The program is fully menu-driven and, after initial installation and set-up, the user no longer needs to refer to the manual. In fact, a significant portion of the manual is devoted to installation of the program onto a hard disk and making floppy disk backups. To make a backup, you actually have to install the program onto a floppy disk. This all comes about because of the copy protection scheme that the author has utilized. More on this later.

Version 1.0 of the program supports the current active ARRL DXCC Countries list of 319 valid countries. The program itself provides no method of updating the table of active countries. That means, of course, that as soon as the next country is deleted or added to the ARRL Countries List, this program is out of date. In a conversation with the author, he indicated that registered owners of the program will be provided with information on updates. However, no cost has been established as yet for such updates. It would have been nice if the program provided for user updating of country list information. Program updates could have then addressed improvements to the program's functional capabilities only. As it stands now, to stay up to date you will have to upgrade the program every time there is a change to the countries list.

Installation and Set-Up

After going through the copy-protection installation procedure you are ready to run the program. Initially, you are presented with a user set-up screen that allows customizing the program with your call sign, the latitude and longitude of your QTH, your printer type and time zone offset from UTC. With this data, the program can compute bearing and range information with pinpoint accuracy because it is based on your specific QTH. Once this database file is created, it becomes a permanent part of the program files. It need not be changed unless you change one of the user parameters that affects this program-initialization process. With the UTC offset for your QTH and using your PC's real-time clock function, the program next can automatically compute sunrise and sunset times. The database file created for this function needs to be recomputed once each new day; but it is a quick, simple process and the program reminds you when it needs to be done.

Having completed the initial installation procedure, you are now ready to use the program. Simply type OP and press the <Return> key. This brings up an opening screen that shows the version number of the program you are using along with the copyright details. From this screen, you are prompted to press the <Return> key to get to the opening menu. Note that if this is the first time you are bringing up the program for that day, a warning screen appears next, indicating that the sunrise/sunset data is invalid for the current date. Function key <F5> from the opening menu will calculate the sunrise/sunset times for the current date.

Operation

The opening screen provides access to seven specific functions and utilizes the function keys to do so. <F1> is for DETAILed information. If you select <F1>, you are then given a sort choice: by continent, country, prefix or zone. I found the sort-by-prefix function to be the most useful. The search function is virtually instantaneous. The screenful of data that is then presented is the most comprehensive set of DX information for the selected country that one could possibly need. The program provides the country's name, prefix, zone, continent, beam heading, distance in nautical and statute miles and kilometers, and both the long-path and return headings. It also provides the country's latitude and longitude, sunrise and sunset times, status of third party and reciprocal agreements, air letter and post-card postage rates, number of IRCs needed for return postage and whether the ARRL Outgoing QSL Bureau will forward QSL cards.

A Notes section provides information such as former prefixes. The Notes section also provides spaces for the user's worked/confirmed records and for a brief, free-form user note. For larger countries, a secondary screen is available with beam headings and sunrise/sunset times for selected cities within the country.

At the opening menu, you can also select the QUICK function. Depressing <F2>, the QUICK function key, provides a multiple-line listing of abbreviated information, again in user-selected sort routines by continent, country, prefix or zone. You can also select the <F3> PRINT key. This enables the convenient printing out of a complete hardcopy listing of the full countries list with abbreviated information.

Special Features

One of the most useful functions of this program is its prefix look-up capability. This capability can be utilized to identify the country for virtually any prefix that you encounter on the bands—past or present. Besides containing an abundance of data on former prefixes, the program also incorporates a prefix database that accommodates the complete ITU prefix-allocations table. In operation, after selecting the sort-by-prefix routine from either the DETAILed or QUICK menu selections, a sub-menu FIND selection is available. Select FIND, enter the prefix and instantaneously the country is identified and the DETAILed screen of comprehensive information for that country is displayed.

I tried this function with a broad selection of special call sign prefixes, such as 8J, 7S and even the upcoming Seoul Olympics special event station which will be signing a 6K prefix. In every case, the program immediately identified the correct country. (In case you are curious about the above three, they are Japan, Sweden and Korea, respectively.) The function of identification of countries by former prefixes is useful but does have its limitations. For the most part these limitations are due to recent changes in prefix allocations by the ITU. For example, if you check DM, instead of displaying East Germany the program comes up with West Germany. One that I checked that I couldn't understand was VP2K. It identified this prefix as assigned to the United Kingdom and Northern Ireland. I had expected it to be identified as the former prefix for either St. Kitts and Nevis or for Anguilla. But then again, if you check the latest ITU prefix allocation chart, it shows this prefix assigned to . . . right, the United Kingdom and Northern Ireland!

Summary

The computerized version of 2nd Op is generally quite useful. It has some anomalies. For example, using the FIND function with the prefix 4U yields ITU Geneva as the answer, it identifies 4U1 as 4U1VIC in Vienna. If you type 4U1U, it identifies as 4U1UN in New York. The anomalies are minor in nature and any but the most inexperienced DXer will be able to intuitively get through them.

A larger problem is the author's unfortunate approach to copy protection of the program. The copy protection scheme permits the user two installations of the program. You can uninstall the program, but here's the rub: when you uninstall it, it doesn't reset the install counter.

I recently replaced the 20-megabyte hard drive in my IBM PC-AT system with a Seagate 40-megabyte drive. The new drive failed after a week's use. The dealer replaced it with no hassle at all. The replacement failed after 2 weeks! I am currently on my third drive which is now some three months old. (I hope this one lasts!) In any event, with the limitation of two installs and assuming I had installed the program on my original hard drive, I would have been out of installs after the first failure. I discussed this problem with the author. He felt that such situations were rare, but that certainly isn't my experience. He felt that under such circumstances, writing a letter and returning the original disk to the program distributor would result in obtaining a replacement disk. There obviously would be a charge for such a service but he had no idea of what it might be.

In summary, on the plus side the program contains a wealth of valuable DX information, is fully menu driven and is extremely user friendly. Negatives are the lack of providing for user updating and the potential problems of the copy protection scheme.

At a suggested retail of $59.95, the program represents a FAIR value. The program is distributed by the *Callbook* Company and should be available from your favorite ham dealer.

by ***Anthony Gargano, N2SS***

-Source: NCJ Journal-

Shortwave Listeners . . .

do yourself a favor and get a copy of Universal Shortwave Radio's brand new catalog. The 52 page high quality publication reveals all the latest entries in this growing market. Receivers and accessories, including efficient antenna systems for those with limited space, are displayed along with one of the largest collection of books on the subject this writer has ever seen. Send $1.00 (or 3 IRCs) to: Universal Shortwave Radio, 1280 Aida Drive, Reynoldsburg, OH 43068, and ask for Catalog 88-11.

MicroSat Update . . .

The newest and Smallest of OSCAR satellites are coming together in Boulder, Colorado. The MicroSats are slated to be launched on an ARIANE III rocket in the June, 1989 time frame.

Some of these little OSCARS will be flying BBSs using BBS programs similar to the W0RLI/WA7MBL software package. Specifically, the PACSAT version of the MicroSats will allow users to make use of a "flying mailbox." The protocol will be AX.25 and will therefore be compatible with a TNC2 and an appropriate PSK modem which are available today.

-Source: Westlink Report-

RTTY TODAY:

(continued from page 10)

For example, one bit (Binary digIT, a 0 or 1) is sufficient to indicate if a light is on or off. However, to represent more complex concepts such as the number system or alphabet, several bits are combined. If two bits are used, four different conditions can be indicated. Since the alphabet has 26 different characters, five bits must be combined for a total of 32 different possible characters.

The most common digital code in use in RTTY is the Baudot code, a five level code. Each character is represented by a digital code five bits long. However, there are only 32 possible combinations using a five level code. Therefore, the Baudot code includes two different character sets, figures and letters; the character sets are alternated as needed. The ASCII code is a seven level code. Using seven bits, there are a total of 128 possible combinations. This eliminates the need for two different character sets.

Once these binary combinations are generated (whether by a mechanical teletype, microcomputer, or some other device) they are sent to a modem (MOdulator DEModulator), often called a Terminal Unit. This device generates (modulates) tones (frequencies) which correspond to the state of each bit for transmission over an analog medium, such as a radio link. The two tones are given special names. The tone corresponding to the binary 1 is called the mark and the tone corresponding to the binary 0 is called the space. This terminology dates back to the early days of telegraphy when an automatic receiving device would lower a pen on a strip chart when a signal was present making a mark; of course, when there was no signal the pen would not touch the strip of paper and a space would result. These tones are then transmitted by a radio transmitter to the receiver(s) where the tones are converted back into digital signals (demodulated) by another modem.

Forms of frequency modulation include FSK (Frequency Shift Keying) and AFSK (Audio Frequency Shift Keying). The difference between the two has to do with the method used to transmit the generated signal. FSK is classified as direct modulation, and AFSK is classified as indirect modulation. In direct modulation, the transmitter carrier frequency is shifted up and down to transmit the analog signal. In indirect modulation, the transmitter's carrier remains stable while an external signal is superimposed upon the carrier. It is the external signal which varies, not the transmitter's carrier. AFSK is usually easier to implement with modern transceivers as all signal generation can be done externally of the transmitter. The audio signal can be simply fed into the transceiver's mic input. Since most transceivers do not include direct FSK ports, some modification is usually necessary to implement FSK directly. Regardless of whether the transmitter is AFSK or FSK controlled, the transmitted signal is the same.

In RTTY, there are several standard speeds at which the digital signals are sent; 45, 50, 75, and 100 bauds. A baud is usually the same are the number of bits send per second. 45 baud is the most popular speed in use. ASCII RTTY is often sent at 110 or 300 baud.

Another RTTY variable is the shift. An audio frequency of 2125 Hz is traditionally used for the mark tone. The frequency of the space tone is dependent on the shift. The most common shift in use is 170 Hz, with a resulting space tone of 2295 Hz. Other common shifts are 425 Hz and 850 Hz. These are often used by commercial RTTY stations outside of the amateur bands. In conclusion, most HF amateur RTTY activity uses a 170 Hz shift and a 45 baud transmission speed.

Equipment

RTTY stations vary a great deal from user to user, so I'll simply mention a few currently available RTTY units. Most of the available units offer several digital modes in addition to RTTY, but all are capable of operating RTTY at several different shifts and speeds. Contact the manufacturers for more information on particular units. Also, look for older units, such as the Kantronics Interface II and the AEA CP1, at hamfests and in the classifieds in amateur radio magazines.

AEA's PK-232 is a multi-mode unit that operates Morse Code, Baudot and ASCII RTTY, AMTOR, Packet, and Facsimile. Kantronics' KAM (Kantronics All Mode) is a similar unit offering the same modes. Both sell for around $300. I have had the opportunity to use both units and was pleased with the performance of each. Another multimode unit is the MFJ1278. The 1278 operates Morse Code (with a builtin memory keyer), Baudot and ASCII RTTY, Packet, Facsimile, and Slow Scan TV. The MFJ-1278 sells for around $250.

MFJ also offers three other RTTY units. The MFJ-1224 operates Morse Code, Baudot and ASCII RTTY, and AMTOR; it sells for about $100. The MFJ-1229, billed as a "deluxe" computer interface, operates the same modes as the 1224, but sells for about $180 and includes a builtin tuning indicator. Finally, the MFJ-1225 is a receive only unit that will decode Morse Code, Baudot and ASCII RTTY, and AMTOR. The 1225 sells for about $70.

Of course, there are other units available. This section is meant to serve as a brief run-down of representative popular RTTY units. Be sure to shop carefully and compare features when buying a RTTY interface.

Operation

RTTY operation occurs on many HF amateur bands. Try tuning around 14.070 MHz to 14.100 MHz and 7.070 to 7.100 MHz. On 80 meters, look around 3.660 MHz to 3.700 MHz. If you are using a SSB transmitter wired for AFSK, select the lower sideband for RTTY operation. Also, unless your transmitter is rated for continuous operation, reduce the power by 50% when transmitting often.

Conclusion

While RTTY is a comparatively old mode, it has continued to hold its own during the development and growth of other digital modes, a testament to RTTY popularity and dependability. RTTY is an excellent HF digital mode; even if you are a devoted packet, CW, or AMTOR operator, you should certainly give RTTY a try. And if you're not yet equipped for digital communications, I strongly urge you to do so; and RTTY provides an excellent starting point. It is a lot of fun and allows you to experiment with the future of radio communications.

If you have any questions or comments, please write to me and enclose a SASE if you would like a reply. Alternately, you can reach me on CompuServe (User ID: 92276,2276).

APLink:

(continued from page 6)

Certainly a zillion APLink systems are not needed or wanted on the ham bands. However, about six to eight more stations that are well run and maintained would be a welcome addition to those already established.

Wrap Up

Well, there you have some basic information about the APLink system. If you want to keep in touch with friends that are far away and either don't have Packet connectivity or don't want to wait for the days of delay that often occurs for coast-tocoast Packet messages, consider AMTOR and APLink. They really fill a need for me. They might for you too!

AMTOR BASICS

Some of the readers may not be too familiar with AMTOR so I will spend a few moments here to discuss the basics. If you're an old AMTOR hand feel free to skip this material.

AMTOR is a system that provides a good (but not perfect) degree of error protection. Just like Packet, AMTOR doesn't really correct errors. Instead, the receiving station makes use of some extra transmitted information to determine if the last data block received contained any errors. If so, the receiving station asks for a repeat. Thus, we really don't have true "error correction". Instead we have error detection and request for repeat. This isn't very sophisticated but it works well in practice. To allow the receiver to detect transmission errors the AMTOR code is constructed so that ratio of ones to zeros in each character is constant at 4 ones and 3 zeros. If the receiving station gets a character that doesn't have 4 ones and 3 zeros it knows there has been an error and the information should be repeated.

AMTOR has two major communications modes. The first is the ARQ (chirp-chirp) mode where one station is the master and one is the slave. The information sending station transmits a block of three characters (210 mS) and the information receiving station responds with a one character message that says, effectively, "I got it OK, send the next block" or "I need a fill, send it again". This simple automatic request for repeat (ARQ) provides a very effective method of exchanging data.

ARQ is great for one-on-one communications but, like Packet, anyone listening in to "read the mail" doesn't get the benefit of error protection. If a monitoring station receives an error it can't ask the sending station for a repeat because it isn't part of the QSO. To solve that problem AMTOR also offers a "broadcast" mode (often called FEC). In the broadcast mode a sending station transmits just like on BAUDOT RTTY in that the key is down, continuously, for the duration of the transmission. However, it differs from BAUDOT in that each character is sent twice, with the second copy of the character sent about 280 mS after the first. So, the receiver gets two tries to correctly receive a character. If the first occurance of the character suffered a noise hit or a chomp from the woodpecker, there's a good chance that the second copy of the character will be received without error. Again, the inforation receiver uses that constant 4 ones to 3 zeros ratio to see if an error has occurred.

Choose the mode that makes sense for the type of communication you want to carry out. Use FEC ("broadcast") when you want to call CQ or have your message received by more than one station. Use ARQ when you want to communicate with a specific station and need very good error protection. Refer to the manual of your AMTOR code converter (some call it a data controller) to see how to transmit and receive using ARQ and FEC.

*by **Paul Newland, AD7I***

HAMCOM For The IBM PC and AEA PK-232

Dan Diehlman, AE6G, has written "Hamcom", an IBM PC (and clone) terminal program that is optimized for operation with the AEA PK-232. Among its unique features is a built-in QSO card file which allows the user to do away with any hardcopy card file collection and provides near- instantaneous responses to call sign searches. Another feature is the low levels of RFI that is generated, which is especially noticeable on HF. Hamcom also supports voice synthesizer output for visually impaired operators. For users that own a Kenwood TS-940 or TS-440 with a computer interface, Hamcom will display a simulated transceiver dial displaying operating frequency, offset frequency, operating mode, etc. To obtain a registered copy of Hamcom, contact AE6G at 5478 N. Bond, Fresno, CA 93710.

-Source: Gateway-

New Entry In ATV Market

AEA is coming to ATV! Advanced Electronic Applications, Inc. has introduced a new FSTV-430 Fast Scan Amateur Television Transceiver designed to get the ATVer on the air witha minimum of fuss. just connect a camera to the front panel-mounted industry standard EIAJ10 connector, hook up a standard TV to display the received signal and your 70 cm antenna, and you are ready to enter the world of fast scan ATV. The transceiver features a high performance UHF GaAs FET preamp, crystalcontrolled downconverter and IF filter outputting on TV channels 3 or 4. The transmitter is a clean one watt PEP using vestigial sideband design and two frequency operation. Contact AEA, P.O. Box C2160, Lynnwood, WA 98036. Phone: (206) 7757373

-Source: WESTLINK Report-

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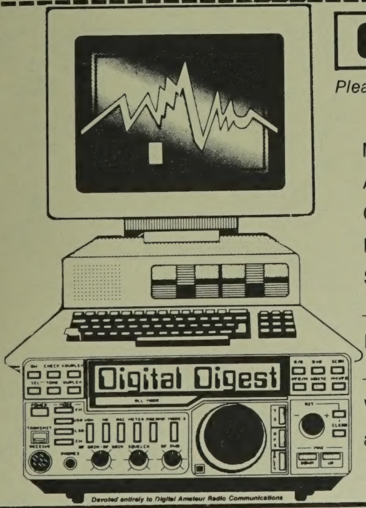
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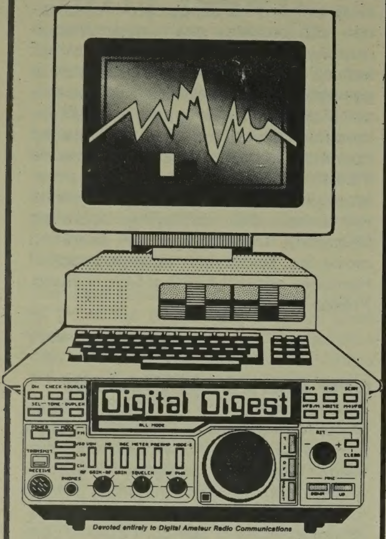
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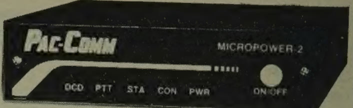

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